# Framework to integrate livestock into rain water management strategies and practices

With a view to developing of a menu of strategies, interventions and practices for integrating livestock into RWM we drafted a framework as indicated in the tables below. These tables are extracted from a 35 page draft report we produced on initial analysis of RWMs for study landscapes (based on past work). There are 14 sub-strategies and associated practices grouped under the following four key categories/strategies:

Strategy I: Increasing spatial and temporal plant water availability (both for food and feed)

Strategy II: Increasing plant water uptake

Strategy III: Improving livestock feed sourcing and feeding techniques

Strategy IV: Improving livestock management

Strategies I and II are the most commonly known RWMs to improve the water productivity of crops. As crop residues constitute important components of livestock diets in the study landscapes, these strategies are considered as an important interface between crops and livestock. Additionally most of the practices under strategies I and II can be applied to grazing land, planted fodder and to on-farm trees.

Strategies III and IV are mainly livestock focused and may/may not be directly linked to water. They enhance efficient use of resources produced in a water productive environment and thus support strategies I and II at system scale.

We share our ideas with you so that we can begin to build them into a common framework. We need first of all to agree terminology related to goals, strategies, interventions and practices and work out how these relate to one another in some kind of hierarchical framework. This is the kind of thing that has been kicked off by Debbie in her Scales and Strategies document. We then need to adjust the strategies laid out here so that they fit within our common framework before developing a more comprehensive list based on ideas from others.

Comments would be welcome.

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18/4/11

Strategy I: Increasing spatial and temporal plant water availability

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| Goal | Sub-strategies and key practices | Impacts | | Trade-offs and risks |
| Livelihood capital | Ecosystem services |  |
| Improving water productivity of crops and livestock feed | *Soil and water conservation*: integrated in-situ physical and biological soil conservation measures such as bunds of different types; fanya juu ; terracing; mulching; conservation tillage; grass strip along the contour; activities that enhance water infiltration ( e.g. frequency, stocking density, timing of grazing) on grazing lands and fallow lands | * Natural capital (e.g. soil conservation); * Social capital ( e.g. health sediment free drinking water; less vulnerable to erratic rain); * Financial capital ( e.g. benefit from increased biomass for feed; increased crop yield and less inorganic fertilizer cost | * More productive ecosystem services; * Conserved water and land can be used for other ecosystem services like carbon sequestration; * Less competition between system elements for water ( e.g. termite) | * Downstream water flow reduced * Requires more labor input * Limits open access to CPR and thus the land less poor may be affected |
| *Water harvesting*: includes ex-situ water harvesting (e.g. underground tanks, roof water harvesting; percolation pit; farm dam; tied ridge; community ponds; farm ponds; zai & planting pit system; large half moons; diversion weir; micro basins for tree). | * Natural capital (e.g. soil conservation); * Social capital ( e.g. health sediment free drinking water; less vulnerable to erratic rain and less time cost to collect drinking water for animal and human); * Financial capital ( e.g. benefit from increased biomass for feed; increased crop yield and livestock productivity and less inorganic fertilizer cost) | * Longer growing period and thus more carbon sequestration; * Improved regulatory services ( e.g. runoff; sediment control) | * Downstream water flow reduced; * More mosquito infestation; * Cost of construction and maintenance for farm pond |
| *Improved drainage:* this could be on crop lands to use the drained water for second cropping, or supplementary irrigation (e.g. BBM; Cut off drains; graded fanya juu) and drainage of grazing land on valley bottom. The drained water can be used for drinking water supply for livestock. | * Social capital (e.g. better health less malaria) * Financial capital ( e.g. better productivity and production of crop * Natural capital ( productive use of water) | May increase plant and diversity thus increase N fixation and pollination | * Wet land drainage may affect water loving species |

Strategy II: Increasing plant water uptake

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| Goal | Sub-strategies and key practices | Impacts | | Trade-offs and risks |
| Livelihood capital | Ecosystem services |  |
| Improving water productivity livestock feed | *Improving species diversity, composition* : management of frequency, seasonality and selectivity of grazing; over sowing; enclosure of degraded grazing lands ( also on CPR) | * Natural capital (e.g. protecting degraded lands); * Financial capital (e.g. feed from rehabilitated lands) | * Better pollination services; * Better plant cover and thus better protective and productive services | * More labor cost; * Limits access to CPR and thus the land less poor may be affected * Incurs costs of inputs like seed |
| *Integrating productive and nutritive species* : intercropping; under sowing of selected annual and perennial legumes on crop land, farm boundaries and fallow lands; control of invasive species ( e.g. grazing lands) | * Natural capital( e.g. increased nitrogen stock); * Financial capital ( e.g. feed produced on farm boundaries | * Nutrient cycling; * Better productive services | * Reduces workability of field; * Some invasive species has cultural value and preferred by some livestock group; * More labor cost |
| *Soil fertility management*: efficient use of manure; better inorganic fertilizer application on crop land; incorporating legume trees and crops as agro-silvo-pasture and silvo-pasture; liming for acidity | * Natural capital (e.g. improved nutrient stock); * Financial capital (e.g. increased crop and feed yield) | * Close nutrient cycling loop and thus less nutrient mining; * Better productive and protective services (e.g. erosion control) | * Competition with household energy supply; * More fertilizer and lime costs; * Limits open grazing ; * If trees not managed tree competes for water |

Strategy III: Improving livestock feed sourcing and feeding

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| Goal | Sub-strategies and key practices | Impacts | | Trade-offs and risks |
| Livelihood capital | Ecosystem services |  |
| Improved feed demand-supply management | *Improving feed quality and practicing supplementary feeding*: this includes selection of higher ME feed, intercropping, urea treatment, chopping of course residues; improved harvesting time, storage and supplementary feeding (e.g. concentrates if available, legumes incorporation in feed, green fodder from fodder bank…) | * Natural capital ( e.g. saves water thus land); * Financial capital ( e.g. from improved animal productivity); * Social capital ( e.g. better availability of milk and nutrition for the children; * Creates opportunity for feed trading | * Feed supplemented with legumes has lower C:N ratio and thus allows organic matter decomposition and faster nutrient turn over; * Higher quality feed saves water which can be used for other ecosystem services ( e.g. carbon sequestration) | * Use of residues affects soil fertility management; * Poor farmers may not afford higher quality feed ; * Requires more labor input and cost of input |
| *Virtual water transfer to more water productive use*: institutional support and creation of incentive mechanisms for local initiatives (e.g. land leasing, feed transfer from surplus to deficit system, feed marketing option. | * Social capital ( e.g. creates market linkage, poor farmers can keep livestock if there is access to feed market); * Financial capital (e.g. open opportunities to trade virtual water to generate income); * Natural capital ( mitigate feed scarcity and thus mitigates over grazing | * Can create opportunities for upstream and downstream community linkage ; * Improved regional and systems water productivity | * Leased lands could be poorly managed and thus may degrade in long term; * On leased land farmers can be hesitant to practice long term land and water management interventions |
| *Matching livestock activity and production level to available feed* : can be a form of awareness creation on how to match cycle of animal production ( activity, production level) with changing availability of sources of nutrient over time | * Hunan capital ( improved knowledge and skills) |  | * Difficult to forecast feed sources from social linkage and CPR |
|  | *Limiting animal movement:* through cut and carry; nearby drinking water supply | * Natural capital ( e.g. reduced compaction of soil | * Tree planting on farm boundary and thus all associated ecosystem services benefits | * More labor demanding |

Table IV: Improving livestock management

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| Goal | Sub-strategies and key practices | Impacts | | Trade-offs and risks |
| Livelihood capital | Ecosystem services |
| Improving livestock productivity | *Selective and cross breeding*: This involves selection of productive local breeds; cross breeding local breeds with exotic breeds | * Natural capital ( better productive animal) * Financial capital (better return per unit of investment?) | Higher milk yielding requires less water per unit of milk and thus are water productive | * Loss of indigenous breed * May affect farmers preferred traits (e.g. hump color etc...) * May los resistance to harsh environmental and disease ( e.g. trypanosomes) |
| *Improving grass root level AI and veterinary service*: policy incentives to involve more private services; Para-vet training for local people | * Natural capital: (e.g. reduced animal mortality) * Human capital (improved knowledge and skills) | * Reduced mortality saves water which can be used for ecosystem services ( e.g. carbon sequestration) | * Cost of the services |
| *Improving proportion of productive animal in the herd:* destocking; matching traction need and oxen owned; multiple use of livestock; timely culling aged and sterile cows, timely heat detection mechanisms | * Financial capital (e.g. higher return per animal) * Natural capital (less grazing area and less feed) | * Higher LWP at herd scale | * Affects herd diversity and risk mitigation strategies of farmers * Loss of cultural values of livestock |
| *Quality drinking water supply*: water harvesting; and developing livestock watering points on irrigation canals; | * Financial capital ( e.g. higher milk yield) * Social capital ( e.g. less time needed to trek livestock to watering points) * Natural capital( drinking points synchronized with feed availability and thus less over grazing) | * Reduced erosion around water points | * Higher cost of production and needs fewer and productive animal; * The poor may not have access to farm pond (land for run off?) |